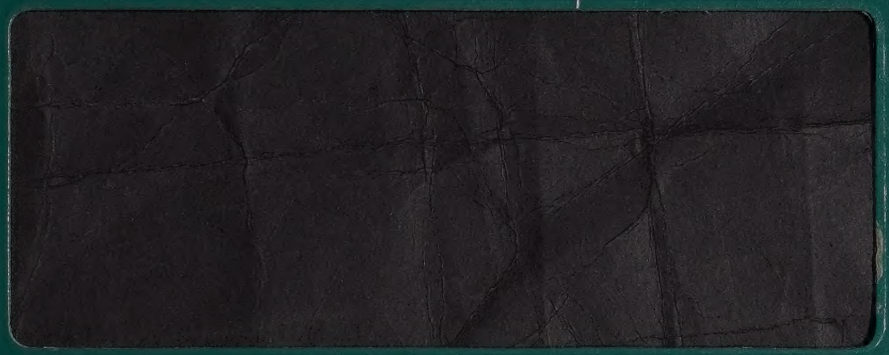

BOONTON
ELECTRONICS
CORPORATION

INSTRUCTION BOOK

MODEL 91-B

Boonton *ELECTRONICS* Corporation

738 SPEEDWELL AVENUE, MORRIS PLAINS, NEW JERSEY, U. S. A.

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BOONTON ELECTRONICS CORPORATION

RF VOLTMETER
MODEL 91B
SPECIFICATIONS

Voltage Range.

1 Millivolt to 3 volts.

Frequency Range.

50 Kilocycles to 500 megacycles.

Accuracy

Range-Full Scale	Accuracy
.01 to 3 volts	5% Full Scale to 200 mc 10% Full Scale to above 200 mc
.003 volt	10% Full Scale to 500 mc.

Input Impedance

52 ohm Probe	High Impedance Probe
VSWR 1.10 Max.	Approx. Cap = 2.5 μμf above 1 volt. Shunt resistance (see curve).

Power Supply

105 to 125 volts; 55-65 c.p.s. 30 watts

Tubes

One 12AX7; one 12AT7; one OA2; one 6X4

Dimensions

7" wide, 11" high, 9" deep
Maximum probe extension 33 in. from instrument.

Weight

13 lbs.

BOONTON ELECTRONICS CORPORATION

RF VOLTMETER

MODEL 91B

1. GENERAL DESCRIPTION

The Model 91B RF Voltmeter is designed to measure radio frequency voltage levels from 1 millivolt to 3 volts over a frequency range of 50 kilocycles to 500 megacycles. Seven ranges from .003 to 3 volts full scale are provided, plus a continuous calibration in decibels covering a range of 70 db.

Two probes are supplied with each instrument, one being a general purpose high impedance probe and the other having a 52 ohm termination with a BNC coaxial connector and low VSWR up to 500 megacycles. Both probes contain a full wave crystal diode detecting circuit providing close to RMS response for all voltage levels below .1 volt. Although the meter is calibfated to read the RMS of a sine wave signal at all voltage levels up to 3 volts, it will be found to be quite reliable for measuring distorted signals in the region of 1 to 100 millivolts.

Even at voltage levels above 100 millivolts, the full wave detector minimizes errors due to non-sinusoidal waveform. The high impedance probe has a shunt capacitance of approximately 2.5 μμf at levels of one volt or higher. At voltage levels of .1 volt or less the input capacitance will approximately double value.

The shunt resistance component is also a variable factor depending upon both voltage and frequency. An approximation of the shunt resistance component may be obtained from curves in Figure 1 for various combination of frequency and voltage. Long-life hermetically sealed germanium diodes are used in both probes.

2. CIRCUIT DESCRIPTION

The Voltmeter utilizes a full wave crystal diode rectifier circuit in each probe where the RF voltage is converted to a DC potential which, in turn is converted to a 60 cycle carrier frequency by means of a low-noise chopper. The 60 cycle carrier is then amplified by a high gain feedback amplifier. The amplifier output is rectified and fed into special circuitry that provides approximately linear meter response on all ranges.

The probes are designed with a large attenuation at 60 cycles to reduce errors that would result if spurious 60 cycle voltage entered the carrier amplifier and mixed with the 60 cycles developed by the chopper.

3. OPERATING PROCEDURE

3.1 Connect power cord to suitable AC power source of from 105 to 125 volts and frequency between 55 and 65 cycles. Set power switch to ON position. Allow a few minutes warm-up period. A 30 minute warm-up period is usually required to insure meeting specified accuracy.

3.2 Select either the "Hi-Z" or"52 ohm" probe as desired and connect to instrument by means of special two conductor flexible shielded cable supplied. Check serial number of probe and see that it is the same as that of the voltmeter.

NOTE:

Meter movement should be set on zero calibration mark with power switch turned off.
Normal meter deflections with zero input signal on probe (Hi-Z probe shorted at input) are as follows:

RANGE	DEFLECTION
.003	$\frac{1}{8}$ to $\frac{1}{4}$ inch.
.01, 03, .1, .3	Zero
1	Zero or slightly suppressed.
3	Suppressed.

3.3 Set RANGE-FULL SCALE switch to appropriate setting for voltage to be measured.

3.4 When using the high impedance probe at high frequencies the ground connection must be as short and direct as possible to minimize errors arising from circulating RF currents in the ground return impedance. Connection to the high side must also be as short as possible to minimize resonance rise effects at frequencies above 100 megacycles.

3.5 When measuring test signal levels greater than .03 volt read appropriate upper scales of meter. If level is below .03 volt read appropriate lower scales of meter.

3.6 The 0-10 DB scale is designed to be used in conjunction with the DB setting of the RANGE-FULL SCALE control. To obtain relative level readings in decibels always add the DB meter reading to the DB setting of the RANGE control. When used with a good signal generator the DB scale greatly facilitates the measurement of relative attenuation and bandpass characteristics of filter networks.

4. PRECUATIONS

4.1 Overload Effects

RF voltages exceeding 10 volts must not be applied to either probe, or permanent damage to the crystal diodes may result. The 52 Ω probe should not be subjected to continuous overloads exceeding 4 volts.

Maximum DC voltage rating for "Hi-Z" probe is 300 volts.
Maximum DC voltage rating for 52 Ω probe is 4 volts.

4.2 Ambient Temperature Effects

The specified full scale voltage accuracy will not be met at excessively high or low ambient temperatures. The normal ambient temperature range for specified accuracy is 65° to 90° F. Do not set the 91B Voltmeter on top of heat radiating equipment or excessive temperature may affect accuracy. Temperature drift effects will also be noticed after soldering to the tip of the high impedance probe. Avoid making permanent probe connections to sources of heat such as socket terminals on high powered vacuum tubes.

4.3 60 Cycle Pick-Up

When measuring low level RF voltages, precautions should be taken to avoid the possibility of erroneous readings resulting from superimposed 60 or 120 cycle pick-up voltages. Always check for this condition by reducing the RF test signal to zero and noting residual meter deflection from hum pick-up.

5. MAINTENANCE

5.1 Periodic Checking

The Model 91B is designed to give long periods of service without maintenance when operated in accordance with these instructions. It is recommended, however, that the instrument be checked occasionally against reliable standards to insure against errors resulting from deterioration of diodes or amplifier tubes. To make these checks it is necessary to have a good signal source in the order of 500 KC with less than 2% distortion at levels up to 3 volts across 50 Ω. A good (averaging response type) electronic voltmeter such as the Ballantine Model 310A to 314 or Hewlett-Packard Model 400D or 400H may be used to monitor the signal source for this purpose. The monitoring meter must be checked, however, to insure its accuracy at some low frequency (100 cycles) of good wave form against a dynamometer type AC meter of at least 1% accuracy.

A set of full scale comparison readings should be taken using both the high impedance probe and the 52 Ω probe. Readings taken with the high impedance probe should not differ from those taken with the 52 Ω probe by a factor greater than indicated in the following table:

RANGE-FULL SCALE	ALLOWABLE PROBE DIFFERENCE
3 volts	2%
1 "	2%
.3 "	2%
.1 "	3%
.03 "	4%
.01 "	5%
.003 "	6%

If the probe difference percentages are appreciably greater than prescribed it is likely that the probe producing the lower set of readings is defective and should be replaced. In this case, it is advisable to

return both the instrument and probes to the factory for proper installation and adjustment of a new set of matched diodes. If the probe differences are less than prescribed, their average value for each range should agree within 5% of the monitor meter. Be sure the 91B has been adequately warmed up for approximately one hour before making this test. Line voltage should be approximately 117 volts. If the average deviation on the one volt range is appreciably greater than 5%, it is advisable to replace the 12AT7 tube and re-check. If the accuracy is not restored try replacing the other tubes or selenium rectifier if necessary to obtain required heater voltage on 12AX7 and 6AU6 tubes. Final accuracy adjustment may be made by means of the number 8 adjusting screw located on the top rear of the amplifier chassis.

With the one volt properly adjusted the other ranges should fall within tolerance. Individual adjustments are provided, however, on all other ranges and these may be re-set if necessary. Individual range adjustments are located on the side of the amplifier chassis and are numbered as follows:

RANGE FULL SCALE	ADJUSTMENT NO.
.003 volt	1
.01	2
.03	3
.1	4
.3	5
3	7

5.2 Effect of Line Voltage on Accuracy

A change of line voltage from 105 volts to 125 volts should produce less than 2% change in meter reading. Changes greater than 2% indicate excessive deterioration of tubes.

5.3 Replacement of Meter Lamps

On instruments having meters manufactured by Q.V.S., Inc. the lamps may be replaced after removing the two holding

screws on the front of the meter cover. Instruments having Marion meters must be removed from their cabinets to permit replacement of lamps from rear of meter.

5.4 Field Replacement Components

The following table lists the most readily replaceable components, their function, and special requirements if any.

COMPONENTS	TYPE NO.	SPECIAL REQUIREMENTS
Rectifier tube	6X4	None
Voltage regulator	0A2	None
Amplifier tube	12AX7	Low noise, non-microphonic
Amplifier tube	6AU6	None
Amplifier tube	12AT7	None
Selenium rectifier	Federal No. 1016	11.5 volts minimum DC output across heater load
Chopper	Stevens-Arnold A-11	Specify power line freq.
Pilot lights & meter bulbs	#47	None
Fuse	1A 3 AG	None

6. SHIPPING INSTRUCTIONS

6.1 If it becomes necessary to ship the instrument for any reason it is essential to make sure that the chopper is properly secured in its socket. It has been found necessary to tie a piece of twine around the hold down clamps at the base of the chopper to prevent the weight of the chopper from spreading these clamps and its falling out during shipment. Very often the clamps are not re-tied when replacing the chopper in the field.

6.2 Wrap the instrument with heavy wrapping paper and seal the seams with gummed tape. Place in fibre-board carton large enough to permit 3 in. of soft packing material between instrument and sides of the box.

91B PARTS LIST

C1	Capacitor, metallized paper	.1 µf ± 20% 200V Aerovox P82
C2	Capacitor, metallized paper	.1 µf ± 20% 200V Aerovox P82
C3	Capacitor, mylar	.022 µf ± 20% 200V Goodall 620M22302
C4	Capacitor, mettalized paper	2.0 µf ± 10% 200V
C5	Capacitor, electrolytic (20 µf/300V)	Part of 40-20-20 µf/ 300-300-25V C.D.XC0732
C6	Capacitor, mylar	.1µf ± 20% 200V Goodall 620M10402
C7	Capacitor, electrolytic (20 µf 25V)	See C5
C8	Capacitor, electrolytic (40 µf 300V)	See C5
C9	Capacitor, mylar	See C3
C10	Capacitor, metallized paper	See C1
C11	Capacitor, mylar	See C3
C12	Capacitor, mica	.001 µf
C13	Capacitor, metallized paper	1.0 µf ± 20% 200V
C14	Capacitor, metallized paper	1.0 µf ± 20% 200V
C15	Capacitor, ceramic	.001 µf
C16	Capacitor, ceramic	.001 µf
C17	Capacitor, ceramic	.001 µf
C18	Capacitor, ceramic	.001 µf
C19	Capacitor, ceramic	.001 µf
C20	Capacitor, ceramic	.001 µf
C21	Capacitor, electrolytic	40 µf 450V for Ser. Nos. below 213 20-20 µf 450V for Ser. Nos. above 213
C22	Capacitor, electrolytic	1000 µf 15V
C23	Capacitor, mylar	See C3
CH1	Chopper	Stevens-Arnold A11
D1	Diode	IN128
D2	Diode, selected	
D3	Diode, selected	

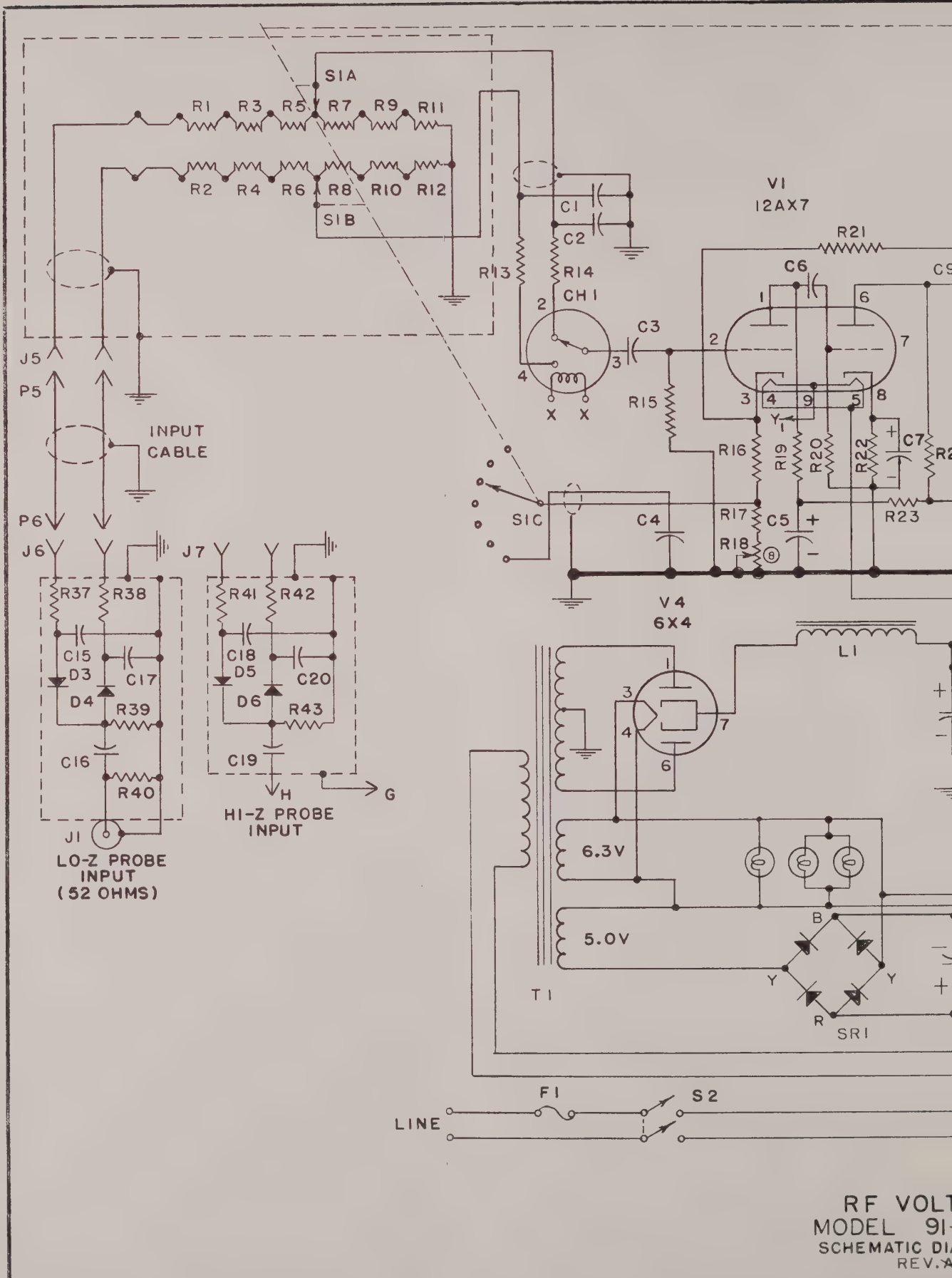
D4	Diode, selected	
D5	Diode, selected	
D6	Diode, selected	
D7	Diode	IN128
F1	Fuse	1A
L1	Choke, filter	Stancor C-1717
M1	Meter	Special

All deposited carbon resistors are ± 1%, ¼W; all composition resistors are ± 5%, ½W, unless otherwise noted.

R1	Resistor, deposited carbon	1 meg.
R2	" " "	1 meg.
R3	" " "	80.6K Ω
R4	" " "	80.6K Ω
R5	" " "	8.87K Ω
R6	" " "	8.87K Ω
R7	" " "	1K Ω
R8	" " "	1K Ω
R9	" " "	191 Ω
R10	" " "	191 Ω
R11	" " "	97.6 Ω
R12	" " "	97.6 Ω
R13	Resistor, composition	47K Ω
R14	" "	47K Ω
R15	" "	2.2 meg.
R16	" "	1K Ω
R17	Resistor, deposited carbon	13K Ω
R18	Resistor, variable	5K Ω ± 20%
R19	Resistor, composition	1 meg.
R20	" "	2.2 meg.
R21	Resistor, deposited carbon	499K Ω
R22	Resistor, composition	6.8K Ω
R23	" "	47K Ω
R24	" "	470K Ω

R25	Resistor, composition	1 meg.
R26	Resistor, deposited carbon	2.26K Ω
R27	Resistor, " "	499K Ω
R28	Resistor, composition	1 meg.
R29	Not used.	
R30	Resistor, composition	470K Ω
R31	" "	22 ohms
R32	" "	1 meg.
R33	" "	100 Ω
R34	" "	22 Ω
R35	Resistor, deposited carbon	7.5K Ω
R36	" " "	3.48K Ω
R37	Resistor, composition	10K Ω
R38	Resistor, composition	10K Ω
R39	Not used	
R40	Resistor, deposited carbon	52 Ω
R41	Resistor, composition	10K Ω
R42	" "	10K Ω
R43	Not used.	
R44	Resistor, power wire-wound	7.5K Ω ± 10% 10W
R45	Resistor, composition	3.3K Ω
R46	" "	470 Ω
R47	Resistor, variable composition	15K Ω ± 20%
R48	" " "	1K Ω ± 20%
R49	" " "	1K Ω ± 20%
R50	" " "	1K Ω ± 20%
R51	" " "	1K Ω ± 20%
R52	" " "	250K Ω ± 20%
R53	" " "	250K Ω ± 20%
R54	Resistor, composition	330K Ω
R55	" "	1K Ω
R56	" "	470 Ω
R57	" "	470 Ω
R58	" "	1K Ω
R59	" "	33 Ω ± 5% 1W
R60	" "	15K Ω
R61	" "	5.6K Ω ± 5% 2W

SR1	Rectifier, selenium	FTR 1016
S1	Switchm special	
S2	Switch, toggle, DPST	
T1	Trnnsformer, power	Stancor P8406 for Ser. Nos. below 213 Stancor P8401 for Ser. Nos. above 213
T2	Transformer, A.F.	Thordarson 20A19



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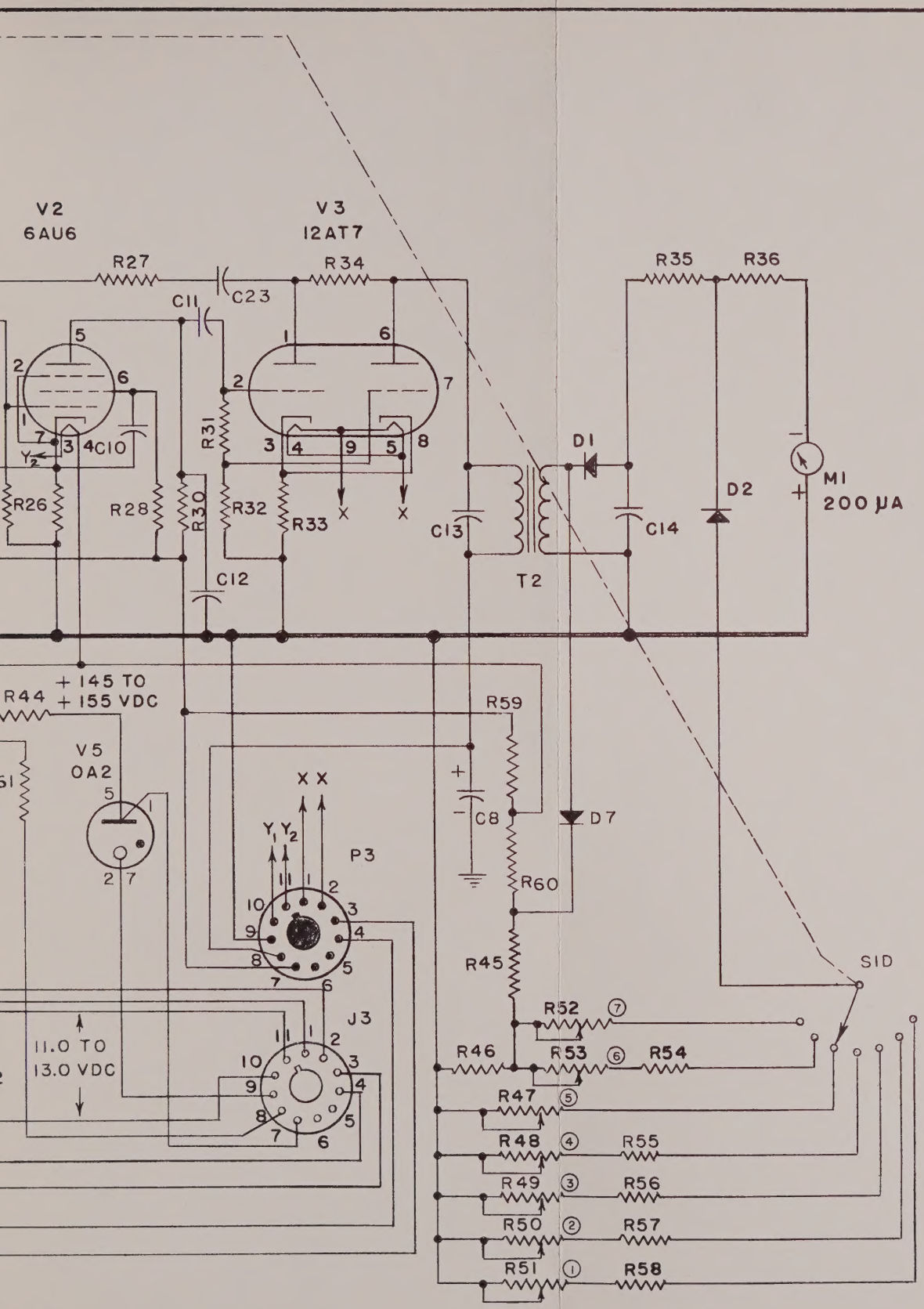

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